TITLE: A Nutritional and Marketing Analysis of Milk-Based, Toddler Drinks on the Market in the United States

AUTHOR: Kerry Jones

A Master's Paper submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Public Health in the Nutrition Program

Heather Wasser

PAPER ADVISOR: Heather M. Wasser, PhD, MPH, RD, IBCLC

ABSTRACT

Background: The first 1,000 days of life is an important window for a child's development that impacts their health throughout their lifetime. Milk-based toddler drinks claim to be nutritionally beneficial for children aged 6-36 months. Despite this claim, medical professionals and public health experts do not recommend these products.

Objective: The objective of this study was to conduct an in-depth analysis of milk-based, toddler drinks for children aged 6-36 months currently on the market in the United States, including the nutritional content, nutrient and health marketing claims, global customer purchasing patterns, and any potential nutritional utility for these products.

Design: Researchers compiled nutritional information and marketing claims from milk-based, toddler drinks currently on the market in the United States, analyzed purchasing patterns of milk-based toddler drinks in the United States and globally, and conducted a literature search of research conducted within the past 10 years that analyzed the energy and nutrient intakes of children 6-36 months of age.

Results: 43 milk-based, toddler drinks were found on the market in the United States, 9 transitional formulas and 34 toddler milks. Toddler drinks varied in their statements of identity, intended age ranges and recommended methods of feeding, contained multiple nutrient and health claims, and frequently contained added sugar. U.S. infants were found to have nutritionally adequate diets on average, while toddlers and young preschoolers had more problematic diets. Toddler drinks sales are on the rise in the United States and globally with the toddler milk formula category being the single largest formula category globally.

Conclusions: Milk-based, toddler drink packages and claims do not align with recommendations from national health organizations and may cause confusion among parents and caregivers about

the healthfulness and necessity of these products. Sales of toddler drinks are increasing globally despite there being no nutritional utility or benefit of these products beyond what a balanced diet and responsive feeding practices could provide. Milk-based, toddler drinks are nutritionally unnecessary and may negatively impact children's feeding development and acceptance of a nutritious, balanced diet.

KEYWORDS: Toddler Feeding, Toddler Drinks, Transitional Formula, Toddler Milks, Marketing Claims, Sales, Usual Nutrient Intakes

INTRODUCTION

The first 1,000 days of life starting with pregnancy through a child's second birthday is a critical window to impact a child's development and lifelong health.[1] Proper nutrition fuels the growth and development of the brain allowing a child to improve their cognitive abilities, enhance their motor skills, and undergo social-emotional development.[1] A child's nutrition throughout the first 1,000 days not only affects how they grow and develop in the early years, but also shapes their risk for obesity and chronic diseases as an adult and can impact the health of their own offspring.[1]

In order to optimize the health of a child during the first 1,000 days of life, the American Academy of Pediatrics (AAP) recommends that infants drink breastmilk or iron-fortified formula for the first year of life and the World Health Organization (WHO) recommends that children be breastfed until at least 24 months old.[2,3,7] When developmentally ready, around 4-6 months of

age, AAP and WHO recommend the introduction of solid foods to complement the nutrition the child is receiving from the breastmilk or infant formula.[2,3,7] After the child's first birthday, AAP recommends that children be weaned from the bottle to develop appropriate feeding skills and prevent dental caries.[2] At this time, children who were previously consuming formula can transition to whole cow's milk, while children who were breastfeeding can continue to breastfeed as long as mutually desired by child and mother.[2]

Despite these recommendations, companies have started to market milk-based, toddler drinks in the United States to contribute to the nutritional intake of young children aged 9-36 months old.[5] Previous research found there are two different types of toddler drinks: "transitional formulas," which are marketed for both infants and toddlers between the ages of 9 to 24 months, and "toddler milks," which are marketed to young children between the ages of 12 to 36 months.[4] Transitional formulas are also marketed as "follow-up formula" or "weaning formula" and toddler milks are also referred to as "grow-up milk" or "young child milk."[4,5,6]

The introduction of these products on the market has raised many concerns. Previous research has found that there are currently no Food and Drug Administration (FDA) regulations or guidance documents to set standards for the identity, ingredients, nutrition labels, or claims for milk-based, toddler drinks.[4] Additional research found that advertisements for toddler drinks imply that toddler milk is 'nutritionally superior' than breastmilk or whole milk along with table food for toddlers.[5] Toddler milks have also been found to cause confusion for parents, since their packaging often resembles infant formula despite being nutritionally inferior to infant formulas.[5]

Despite toddler drinks being marketed as advantageous for toddlers' growth and development, medical and public health experts do not recommend them. A consensus statement released from the Academy of Nutrition and Dietetics (AND), AAP, the American Academy of Pediatric Dentistry (AAPD), and the American Heart Association (AHA) stated that toddler milks contribute no nutritional benefit beyond what children would be achieving through a healthy diet.[6] WHO stated that follow-up formula is not a suitable replacement for breastmilk and is overall unnecessary.[7] University of Connecticut's Rudd Center for Food Policy and Obesity found that milk-based toddler drinks fail to support children's development of adequate dietary behaviors, acceptance of the family's diet, and healthy food preferences, particularly fruits and vegetables.[5]

This study was designed to fill a gap in research by conducting an in-depth analysis of milk-based, toddler drinks for children aged 6-36 months currently in the market in the United States, including the nutritional content, nutrient and health marketing claims, global customer purchasing patterns, and any potential nutritional utility for these products.

METHODS

In order to effectively analyze the milk-based, toddler drinks on the market in the United States, this study analyzed the nutrient content and marketing claims of toddler drinks from manufactures' websites, examined consumer purchasing patterns of milk-based, toddler drinks in the United States and globally, and conducted a literature search to analyze the energy and

nutrient intakes of children aged 6-36 months in the United States. All research was completed as of October 29, 2019.

Part 1: Nutritional and Marketing Analysis of Milk-Based, Toddler Drinks

To identify milk-based, toddler drinks, including transitional formulas and toddler milks, currently on the market in the United States, researchers compiled a list of milk-based, toddler drinks marketed for children up to 36 months of age for sale online as of October 2019 at the 2019 top 10 retailers in the United States, according to the National Retail Federation.[8] Toddler drinks were excluded if they required a prescription from a medical professional to purchase or were intended for a special medical condition, such as amino acid-based formulas. Utilizing the information provided on the manufactures' websites, researchers input the brand and product names, nutrition and health claims, age for which the product was intended, preparation instructions, and the nutrient information, including serving size, calories, macronutrients, micronutrients, and ingredients, into a Microsoft Excel spreadsheet.

Part 2: Consumer Purchasing Analysis of Milk-Based, Toddler Drinks

In order to analyze the demographics of consumers of milk-based, toddler drinks and sales of milk-based, toddler drinks in the United States and globally, researchers analyzed purchasing data of milk-based, toddler drinks in the United States and globally utilizing Euromonitor. Additionally, researchers conducted a literature search in PubMed and Euromonitor of existing

research and publications within the past 10 years that discussed the sales and demographics of milk-based, toddler drink consumers globally.

Part 3: Analysis of the Nutritional Intakes of Children Aged 6-36 Months

The researchers analyzed the nutritional intakes of children aged 6-36 months in the United States to assess the nutritional utility of milk-based, toddler drinks. Researchers conducted a literature search in PubMed of existing research published within the past 10 years that previously analyzed the nutritional intakes of children aged 6-36 months in the United States. Additionally, researchers conducted a literature search in PubMed of existing research published within the past 10 years that analyzed the nutritional utility of milk-based, toddler drinks for children 6-36 months of age.

RESULTS

Researchers identified 43 milk-based, toddler drinks from 16 different manufacturers for sale in the United States (Table 1). Nine products were marketed as transitional formulas intended for children 9-18 months, 9-24 months, 6-24 months, or 6-36 months and 34 products were marketed as toddler milks for children over 1 year, between 12-24 months, or between 12-36 months. There was no consistent statement of identity for either the transitional formulas or the toddler milks. The transitional formulas were labeled as “infant & toddler formula” and “infant formula.” The toddler milks were labeled as “toddler nutritional drink,” “milk drink,” “milk beverage,” “toddler drink,” “toddler milk drink,” and “toddler formula.” Additionally, two transitional formulas and two toddler milks were labeled as “follow-up formula.”

Table 1: 43 Milk-based toddler drinks for sale by top retailers in the United States by manufacturer and type of milk-based, toddler drink (October 2019)	
Manufacturer	**Product Name**
A2 Platinum	
Toddler Milk	Premium Toddler Milk Drink
AMilk Nutrition	
Toddler Milk	Toddler Growth 2 Formula
Baby's Only	
Toddler Milk	1) Organic Non-GMO Dairy Toddler Formula; 2) Organic Non-GMO DHA/ARA Formula; 3) Organic Non-GMO Dairy Whey DHA/ARA Formula; 4) Organic Non-GMO LactoRelief with DHA & ARA Toddler Formula; 5) Organic Non-GMO Dairy Whey Formula; 6) Organic Non-GMO Soy Formula; 7) Non-GMO Cholov Yisroel Formula; 8) Organic Non-GMO Pea Protein Formula
Comforts	
Transitional Formula	Toddler Beginnings Milk-Based Infant Formula w/ Iron
CVS Health	
Transitional Formula	Toddler & Infant Formula w/ Iron
Danone	
Transitional Formula	Dexolac Premium Stage 2 Follow Up Formula
Toddler Milk	Dexolac Premium Stage 3 Follow Up Formula
Earth's Best	

Toddler Milk	Organic Toddler Milk Drink
Enfamil	
Transitional Formula	1) Enfagrow Premium Toddler Transitions, Infant & Toddler Formula; 2) Enfagrow Toddler Transitions Gentlease, for Fussiness, Gas, Crying
Toddler Milk	1) Enfagrow Premium Toddler Nutritional Drink (Natural Milk Flavor); Enfagrow Premium Toddler Nutritional Drink (Vanilla Flavor); 3) Enfagrow NeuroPro Toddler Nutritional Drink (Natural Milk Flavor); 4) Enfagrow NeuroPro Toddler Nutritional Drink (Vanilla Flavor); 5) Enfagrow Toddler Next Step Milk Drink
Gerber	
Transitional Formula	Good Start Soy Powder Infant & Toddler Formula
Toddler Milk	1) Good Start Grow Nutritious Toddler Drink; 2) Natura Stage 3 Organic Toddler Milk
Kabrita	
Toddler Milk	Goat Milk Toddler Formula
Happy Tot	
Toddler Milk	Organic Toddler Milk
Munchkin	
Toddler Milk	Grass Fed Toddler Milk Drink
Nestle	
Transitional Formula	Lactogen 2 Follow-Up Formula
Toddler Milk	1) Nido 1+; 2) Nido Lacto-Ease; 3) Lactogen 3 Growing Up Milk Formula

Parent's Choice	
Transitional Formula	Toddler Beginnings 2 Formula for Older Infants
Toddler Milk	1) Toddler Next Stage 3 Milk Drink (Natural Milk Flavor); 2) Toddler Next Stage 3 Milk Drink (Vanilla Flavor)
Similac	
Toddler Milk	1) Go & Grow Non-GMO with 2'-FL HMO Toddler Drink; 2) Go & Grow Toddler Drink; 3) Go & Grow Sensitive Non-GMO Toddler Drink; 4) Pure Bliss Toddler Drink; 5) Lamehadrin Toddler Drink
Up&Up	
Transitional Formula	Toddler Beginnings Infant Formula with Iron
Toddler Milk	1) Toddler Next Stage Formula (Natural Milk Flavor); 2) Toddler Next Stage Formula (Vanilla Flavor)

All of the milk-based, toddler drink packages included at least one nutrient or health claim on the front of the package (Table 2). The most common health & nutrient claims found on transitional formulas were claims of supporting brain development and health, healthy growth, and immune health and support. However, the most frequent health & nutrient claims found on toddler milks were claims of supporting brain development and health, immune health and support, eye development and health, and bone strength and health. Additional claims found on the front of milk-based, toddler drinks were claims of easing fussiness, gas, and crying, providing nutrients that milk alone cannot provide, and helping to balance a toddler's diet.

Table 2: The 7 most frequent front of package health and nutrient claims displayed on 43 milk-based toddler drink packages for sale in the United States by type of milk-based, toddler drink (October 2019)

Health & Nutrition Claim[a,b]	**# of Transitional Formulas with Claim** (n = 9 packages)	**# of Toddler Milks with Claim** (n = 34 packages)
Bone Strength/Health	0	7
Brain Development/Health	7	19
Eye Development/Health	1	7
Digestive Health[c]	0	2
Healthy Growth	2	5
Immune Health/Support	2	13
Overall Child Development	0	5

a. Does not include claims relating to health certifications, including but not limited to organic, non-GMO, gluten-free, Kosher, Halal

b. Front of package claims were obtained from manufactures websites

c. Does not include claims about the product being easy to digest or any claims related to the lactose, soy, or milk content

Additionally, the milk-based, toddler drinks varied in the method of feeding displayed or mentioned in the preparation instructions (Table 3). Two (22.2%) of the transitional formula packages and fourteen (41.2%) of the toddler milk packages featured or mentioned only a sippy cup, while three (33.3%) of the transitional formula packages and twelve (35.3%) of the toddler milk packages pictured only a bottle.

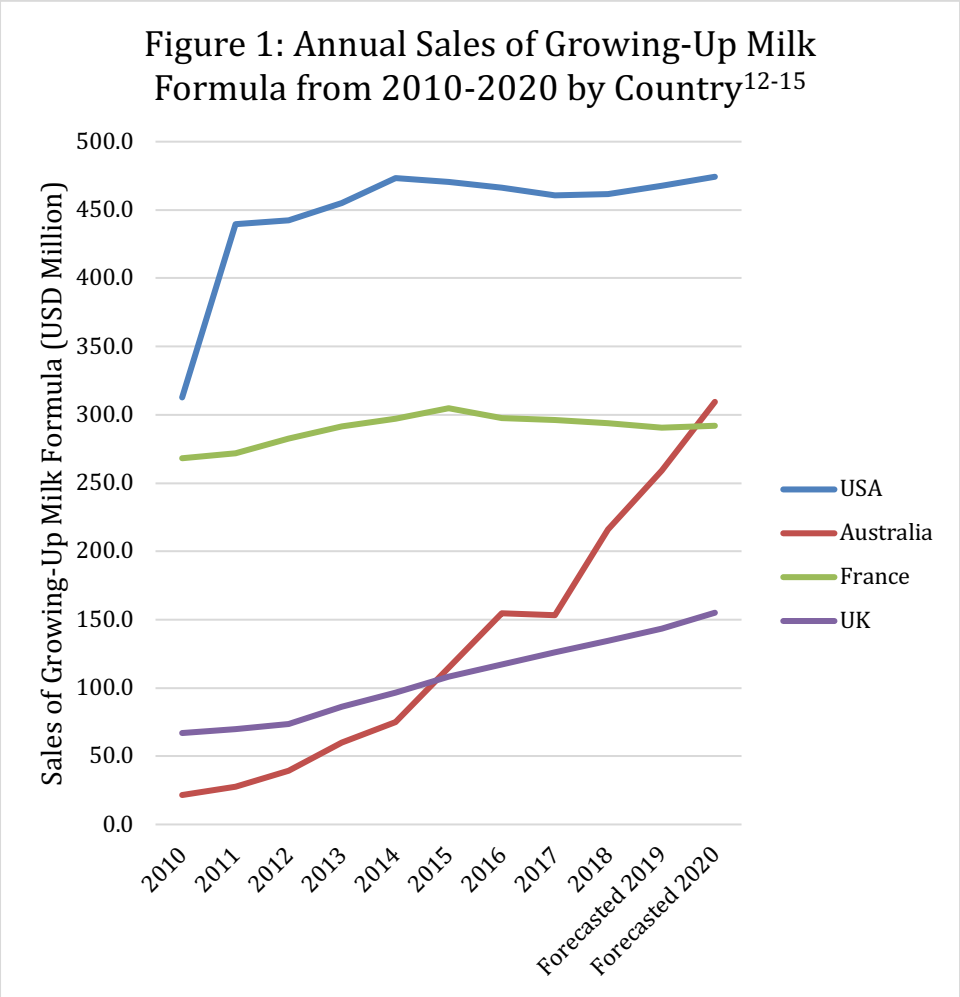
Table 3: The method of feeding displayed or mentioned found on 43 milk-based toddler drink packages for sale in the United States by type of milk-based, toddler drink (October 2019)

Method of Feeding Displayed or Mentioned[a]	# of Transitional Formulas with Feeding Method (n = 9 packages)	# of Toddler Milks with Feeding Method (n = 34 packages)
Sippy Cup Only	2	14
Bottle Only	3	12
Sippy Cup & Bottle	3	0
Ready to Drink Container	0	2
Glass	0	1
Bowl	1	1
None Mentioned	0	4

a. Method of feeding displayed or mentioned on toddler drink containers were obtained from the manufacturer's or seller's websites

Milk-based, toddler drinks have been called an "ingenious way of expanding the milk formula market" (p. 1) with the toddler milk formula market worth $2.7 billion globally in 2007 and $41 billion globally in 2014.[9,10] Toddler milk formulas are currently the single largest milk formula category globally, ahead of standard milk formula for newborns and follow-on milk formula for older infants.[10] China is the largest consumer of milk-based, toddler drinks with over 40% of sales alone; however, sales of these products are on the rise in the United States as well as other countries (Figure 1).[10,11] In the United States, growing-up formula had the strongest rise in value among all baby foods in 2018.[16] However, the Feeding Infants & Toddler Study (FITS) 2016 reported only 15 children, out of the 2,340 children between the ages of 9-23.9 months, who consumed toddler milks: three 9-11.9 month olds, six 12-14.9 month olds, five 15-17.9 month olds, one 18-20.9 month old, and zero 21-23.9 month olds.[17,18] The National Health and Nutrition Examination Survey (NHANES) 2013-2014 reported 1 child consuming a milk-based,

toddler drink, while NHANES 2015-2016 reported 2 children consuming a milk-based, toddler drink.[19,20]



According to FITS 2016 and NHANES 2009-2012, the dietary intakes of infants (0-11.9 months old) in the United States were largely nutritionally adequate with the exception of low iron and vitamin D intakes for older infants (6-11.9 months old).[21,22] However, toddlers (12-23.9 months old) and young children (24-47.9 months old) were found to have diets that were "somewhat problematic" with small quantities of "healthy food" and higher quantities of higher calorie

foods.[23] This resulted in intakes of sodium and saturated fat that often exceeded the adequate intake or macronutrient distributions ranges and intakes of fiber, vitamin D, and potassium that fell short of dietary recommendations.[22,23] Additionally, FITS 2016 and NHANES 2009-2012 found that more than half of toddlers were at-risk of inadequacy for vitamins E based on the Estimated Average Requirements (EAR) in addition to vitamin D.[21,22] Many toddlers and young preschoolers (24-35.9 months old) were found to have intakes that exceeded the Adequate Intakes (AI) of retinol (16-26% and 46%, respectively), and zinc (41-43% and 56%, respectively).[21,22] Almost two-thirds of young preschoolers also exceeded the AI for vitamin K.[21,22]

Milk-based, toddler drinks were found to vary in the ingredients and nutrients they contained. 60.6% of toddler milks and 77.8% of transitional formulas contained nonfat milk as the first ingredient. The most common second and third ingredients in transitional formulas were vegetable oil (66.7%) and corn syrup solids (55.6%), respectively. While the most common second ingredients in toddler milks were lactose (24.2%) and corn syrup solids (18.2%), and the most common third ingredient in toddler milks was vegetable oil (66.7%). Additionally, 33 of the 43 milk-based, toddler drinks, 7 transitional formulas and 26 toddler milks, contained added sugar in the following forms: sugar, lactose, sucrose, corn syrup, honey, glucose syrup, and brown rice syrup. Toddler milks were found to have an average of 13.76 gm of sugar per 8 fl oz, which is higher than the sugar content found in an equivalent amount of whole cow's milk (12.32 gm).[24] Toddler milks with a vanilla flavor were found to have one additional gram of sugar per serving compared to the natural milk flavor version of the toddler milk.

Table 4 compares the nutritional composition of whole cow's milk and soy milk to milk-based toddler drinks for the nutrients identified as problem areas for children aged 12-35.9 months old based on the FITS 2016 results. Whole cow's milk and soy milk were found to be better sources of vitamin D and potassium and a lower source of vitamin E than milk-based toddler drinks, all nutrients at-risk for inadequacy in 12-36 month-olds. For nutrients typically consumed in excess by 12-36 month-olds, milk-based toddler drinks were higher sources of vitamin K, cow's milk was a higher source of saturated fat, and soy milk was a higher source of vitamin A and sodium when comparing all three products.

Table 4: Nutritional composition of 8 fl oz of whole cow's milk, soy milk, and 43 milk-based toddler drinks analyzing the nutrients identified to be frequently out of line with dietary recommendations for children aged 12-35.9 months old (October 2019)

Nutrient[a]	**Recommendation for Child Aged 12-35.9 mo**[b]		**Whole Cow's Milk**[c]	**Soy Milk**[c]	**Transitional Formula**[d] (Range)	**Toddler Milk**[e] (Range)
	AMDR/EAR	AI				
Saturated Fat (g)	-	-	4.55	0.5	3 (2.7-3.3)	2.9 (0.6-4.9)
Dietary Fiber (g)	-	19	0	1.5	-	0.3 (0-1.7)
Vitamin A (µg RAE)	210	-	118.5	150.3	144.1 (121.6-167.4)	55.4 (16.8-121.6)

Vitamin D (µg)	10	-	3.1	4.5	2.3 (1.8-2.4)	3.1 (1-5.3)
Vitamin E (mg)	5	-	0.15	-	2.3 (1.0-3.2)	1.6 (0.8-2.3)
Vitamin K (µg)	-	30	0.7	-	13.2 (7.1-14.4)	11.6 (6.1-15.4)
Potassium (mg)	-	3000	322	299	197.7 (135.1-210.9)	301.4 (168.9-550)
Sodium (mg)	-	1000	105	119	62.5 (50.7-95.9)	77.7 (45-120)
Zinc (mg)	2.5	-	0.9	0.6	1.4 (0.9-1.6)	0.7 (0.3-2.8)

a. Nutrients utilized were based on FITS 2016 results that children aged 12-47.9 months old consumed at levels that exceeded or fell short of recommendations (21,23)

b. DRI values for children 12-47.9 months old are from FITS 2016 results that utilized DRIs from the Institute of Medicine Food and Nutrition Board. (21)

c. Nutritional composition of whole cow's milk and soy milk from *A Comparison of the Nutritional Value of Cow's Milk and Nondairy Beverages* (24)

d. Analysis of the mean nutritional content for each nutrient from 9 transitional formulas on the market in the United States, except for saturated fat, which was only reported by 2 transitional formulas. These values were gathered from the nutrition facts label on the back of the package.

e. Analysis of the mean nutritional content for each nutrient from 34 toddler milks on the market in the United States, except for saturated fat, fiber, vitamin A, vitamin E, vitamin K, potassium, and zinc, which were only reported by 18, 22, 33, 33, 5, 31, and 33 toddler milks, respectively. These values were gathered from the nutrition facts label on the back of the package.

DISCUSSION

This analysis of toddler drinks identified 43 milk-based, toddler drinks consisting of 9 transitional formulas and 34 toddler milks for sale in the United States with wide variation in their statements of identity and targeted age ranges. Some of the toddler drinks referred to

themselves as “toddler and infant formulas,” which was previously found to not be a clear or legally defined term, or “infant formulas,” which conflicted with the FDA’s definition of an infant as not older than 12 months old.[4] In combination with results from other studies that found toddler drink labels, branding, and packages are visually similar to those of infant formulas, this can lead to confusion among parents and caregivers, including difficulty distinguishing between toddler drinks and infant formulas and believing that less-expensive toddler drinks are appropriate for infants, despite being nutritionally inferior.[4,5,25]

Milk-based, toddler drink packages featured a wide variety of health and nutrient claims with all packages including at least one front-of-package claim. A large portion of these claims stated that the nutrients they contained could improve children’s overall health or help the development or health a specific part of the body (e.g., brain, bones, eyes). Several packages featured claims that implied they could fill nutritional gaps and help balance a toddler’s diet, while one package featured a claim that suggested superiority over milk by providing nutrients that milk alone could not provide. These claims go against previous research that found that milk-based, toddler drinks are not nutritionally superior to cow’s milk, offer no nutritional value beyond what could be obtained from healthy foods, are overall not nutritionally necessary, and are not recommended by professional health organizations.[6,26-28] Furthermore, it is well-known that early childhood is a time of exploring new foods, which can lead to the development of picky eaters during this time. Therefore, these marketing claims have been found to mislead parents and caregivers of young children about the healthfulness and necessity of these products for developing toddlers, especially if they are concerned about their child’s eating habits and behaviors.[25,29]

Milk-based, toddler drinks also varied in the recommended method of feeding displayed or mentioned on the packaging. Fifteen toddler drinks, 12 of which are toddler milks marketed to only children over 12 months old, depicted images of or mentioned only bottles in their preparation and feeding instructions. These feeding recommendations go against AAP recommendations that children should be weaned from the bottle by 12 months old in order to develop appropriate feeding skills and prevent the formation of dental caries.[2] Therefore, parents and caregivers feeding their children milk-based, toddler drinks through a bottle could be negatively impacting their child's feeding development and dental health.

This analysis of toddler drinks found that sales of milk-based, toddler drinks are increasing globally with more sales of these products than any other formula category, including standard milk formula for newborns.[10] In 2016, sales of toddler drinks in the United States totaled $466.1 million.[13] During the same year, FITS and NHANES results reported only 15 and 2 children consumed toddler drinks, respectively.[17,20] These surveys claim to have nationally representative samples; however, consumption of toddler drinks by U.S. young children is not being adequately captured. More research is needed to determine who is consuming milk-based, toddler drinks in the U.S. and why consumption of these products is not captured by these supposedly nationally representative studies.

Total usual nutrient intakes of U.S. infants, as shown by FITS 2016 and NHANES 2009-2012, are largely nutritionally adequate; however, after a child's first birthday the likelihood of inadequate intakes of various nutrients increases. U.S. children between the ages of 1-3 years have been found to have higher intakes of sodium, saturated fat, retinol, and zinc, while

consuming lower amounts of fiber, vitamin D, and potassium.[22,23] Previous research conducted in other high-income countries has shown that milk-based, toddler drinks can increase intakes of carbohydrates, essential fatty acids, vitamins (A, C, D, all B (except B12), E), iron, zinc, and dietary fiber.[30-34] However, there are several flaws with these studies. One, these studies compare toddler drinks to unfortified cow's milk; however, the United States fortifies cow's milk with vitamin D. Comparison of the vitamin D levels in whole cow's milk and soy milk to the average amount of vitamin D found in toddler drinks showed that toddler drinks were found, on average, to have lower amounts of vitamin D than both whole cow's milk and soy milk in the United States.[24] Additionally, these studies analyze the nutrient distribution differences between toddler drink consumers verse non-consumers; however, they do not note any additional differences in the children's diets outside of toddler drink consumption. Therefore, additional research is needed on the reasons parents and caregivers serve milk-based, toddler drinks to their children and the dietary and development differences between children consuming toddler drinks versus non-consumers. We also found that 76.7% of the milk-based, toddler drinks were found to have added sugars beyond the lactose naturally contributed by milk. The addition of sugar to drinks for young children is not recommended by health organizations and has been found by previous research studies to increase glucose and insulin response significantly more than regular cow's milk.[6,25,35] Therefore, we determined there is no nutritional utility for milk-based, toddler drinks for children in the United States. Instead, parents and caregivers should be encouraged to prevent and rectify any nutrient inadequacies with a balanced diet, responsive feeding practices, and repeated exposures to healthy foods.[6,35]

This study adds to the currently available literature by analyzing the nutritional content and marketing claims of milk-based, toddler drinks on the market in the United States, examining the consumer purchasing patterns of milk-based, toddler drinks in the United States and globally, and analyzing the nutritional utility of milk-based, toddler drinks for children 6-36 months of age in the United States. We found that toddler drink packages and claims do not align with recommendations from national health organizations and may cause confusion among parents and caregivers about the healthfulness and necessity of these products. Additionally, we found that sales of toddler drinks are increasing globally despite there being no nutritional utility or benefit of these products beyond what a balanced diet and responsive feeding practices could provide.

This study is not without limitations. We did not analyze the packages of these products in-person; therefore, the nutrient and health claims, statements of identity, method of feeding, or age recommendations could be different if the packages available for purchase in stores are different from that found in pictures online. Additionally, we did not analyze the claims made on manufacturers' or online sellers' websites; therefore, parents comparing or purchasing products online may encounter additional health or nutrient claims that were not captured in this study. As previously mentioned, FITS and NHANES datasets did not capture enough children consuming milk-based, toddler drinks; therefore, analysis of the nutritional utility of these products was based solely on comparing the nutrients found in milk-based, toddler drinks to cow's milk and soy milk to the usual nutrient intakes previously reported by these studies. Future research is needed to compare the usual nutrient intakes of children consuming toddler drinks to non-

consumers in order to gain a better picture of the impact of these products on a child's nutrient intake and feeding development.

CONCLUSIONS

Milk-based, toddler drinks are nutritionally unnecessary and may negatively impact children's feeding development and acceptance of a nutritious, balanced diet. Despite this, manufacturers continue to produce and market toddler drinks in the United States and parents and caregivers continue to purchase these products for their children at high rates. There needs to be increased research to analyze the nutritional impact of toddler drinks and to identify the reason parents and caregivers continue to purchase these products. Additionally, the FDA needs to set regulation standards for the identity, ingredients, and marketing of toddler drinks in the United States. Health professionals need to educate parents about the inappropriateness of milk-based, toddler drinks for children 6-36 months of age and, instead, encourage parents and caregivers to offer children nutritious, balanced meals and enact responsive feeding practices to ward off and rectify any nutrient inadequacies.

REFERENCES

1. Martinez Sullivan L, Brumfield C. *The First 1,000 days: Nourishing America's Future.* Washington, DC: 1,000 Days; 2016. https://thousanddays.org/wp-content/uploads/1000Days-NourishingAmericasFuture-Report-FINAL-WEBVERSION-SINGLES.pdf. Accessed September 1, 2019.

2. Holt K, ed. *Bright Futures: Nutrition.* 3rd ed. American Academy of Pediatrics; 2011. https://brightfutures.aap.org/Bright%20Futures%20Documents/BFNutrition3rdEdPocketrdEdP.pdf. Accessed September 1, 2019.
3. Infant and young child feeding. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/infant-and-young-child-feeding. Published February 16, 2018. Accessed September 1, 2019.
4. Pomeranz JL, Romo Palafox MJ, Harris JL. Toddler drinks, formulas, and milks: Labeling practices and policy implications. *Prev Med.* 2018; 109:11-16. https://www.ncbi.nlm.nih.gov/pubmed/29339115. Published January 12, 2018. Accessed September 1, 2019.
5. Harris JL, Fleming-Milici F, Frazier W et al. *Baby Food Facts 2016: Nutrition and marketing of baby and toddler foods and drinks*. UConn Rudd Center for Food Policy and Obesity; 2016. http://www.uconnruddcenter.org/files/Pdfs/BabyFoodFACTS_2016_FINAL_103116.pdf. Accessed September 1, 2019.
6. Lott M, Callahan E, Welker Duff E, Story M, Daniels S. *Healthy beverage consumption in early childhood: recommendations from key national health and nutrition organizations.* Durham, NC: Healthy Eating Research; 2019. https://healthyeatingresearch.org/wp-content/uploads/2019/09/HER-HealthyBeverage-ConsensusStatement.pdf. Accessed September 30, 2019.
7. *Information concerning the use and marketing of follow-up formula.* World Health Organization; 2013.

https://www.who.int/nutrition/topics/WHO_brief_fufandcode_post_17July.pdf. Accessed September 1, 2019.

8. Stores Top Retailers 2019. Stores: NRF's Magazine. https://stores.org/stores-top-retailers-2019/. Accessed September 1, 2019.
9. Foods and beverages for toddlers – a highly dynamic sector. Passport. www.portal.euromonitor.com. Published September 17, 2007. Accessed October 1, 2019.
10. Bandy L. Toddler milk formula: The Hello Kitty of Packaged Food. Passport. https://blog.euromonitor.com/toddler-milk-formula-the-hello-kitty-of-packaged-food/. Published February 10, 2014. Accessed October 1, 2019.
11. Milk formula in the China – Datagraphics. Passport. www.portal.euromonitor.com. Published September 2019. Accessed October 1, 2019.
12. Milk formula in Australia – Datagraphics. Passport. www.portal.euromonitor.com. Published November 2018. Accessed October 1, 2019.
13. Milk formula in USA – Datagraphics. Passport. www.portal.euromonitor.com. Published September 2018. Accessed October 1, 2019.
14. Milk formula in France – Datagraphics. Passport. www.portal.euromonitor.com. Published August 2019. Accessed October 1, 2019.
15. Milk formula in United Kingdom – Datagraphics. Passport. www.portal.euromonitor.com. Published August 2019. Accessed October 1, 2019.
16. Baby Food in the US – Analysis. Passport. www.portal.euromonitor.com. Published September 2018. Accessed October 1, 2019.
17. Andrea S. Anater, email communication, November 3, 2019.

18. Anater AS, Catellier DJ, Levine BA et al. The feeding infants & toddlers study (FITS) 2016: study design and methods. *J Nutr.* 2018; 148(Suppl 3):1516S-1524S. https://www.ncbi.nlm.nih.gov/pubmed/29878140. Published June 5, 2018. Accessed September 1, 2019.
19. NHANES 2013-2014 Dietary Data. Centers for Disease Control and Prevention. https://wwwn.cdc.gov/nchs/nhanes/ContinuousNhanes/Default.aspx?BeginYear=2013. Accessed September 1, 2019.
20. NHANES 2015-2016 Dietary Data. Centers for Disease Control and Prevention. https://wwwn.cdc.gov/nchs/nhanes/search/datapage.aspx?Component=Dietary&CycleBeginYear=2015. Accessed September 1, 2019.
21. Bailey RL, Catellier DJ, Jun S et al. Total usual nutrient intakes of US children (under 48 months): findings from the feeding infants and toddlers study (FITS) 2016. *J Nutr.* 2018; 148(Suppl 3):1557S-1566S. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6126633/. Published June 5, 2018. Accessed September 1, 2019.
22. Ahluwalia N, Herrick KA, Rossen LM et al. Usual nutrient intakes of US infants and toddlers generally meet or exceed Dietary Reference Intakes: findings from NHANES 2009-2012. *Am J Clin Nutr.* 2016; 104(4):1167-74. https://www.ncbi.nlm.nih.gov/pubmed/27629049. Published September 14, 2016. Accessed September 1, 2019.
23. Dwyer JT. The feeding infants and toddlers study (FITS) 2016: moving forward. *J Nutr.* 2018; 148(Suppl 3):1575S-1580S. https://academic-oup-com.libproxy.lib.unc.edu/jn/article/148/suppl_3/1575S/5086685. Published June 5, 2018. Accessed September 1, 2019.

24. Singhal S, Baker RD, Baker SS. A comparison of the nutritional value of cow's milk and nondairy beverages. *J Pediatr Gastroenterol Nutr.* 2017; 64(5):799-805. https://www.ncbi.nlm.nih.gov/pubmed/27540708. Published May 2017. Accessed September 1, 2019.

25. Scott J, Davey K, Ahwong E, Devenish G, Ha D, Do L. A comparison by milk feeding method of the nutrient intake of a cohort of Australian toddlers. *Nutrients.* 2016; 8(8): 501. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4997414/. Published August 16, 2016. Accessed September 1, 2019.

26. Palafox MJR, Harris JL. Toddler formulas: nutritional value and marketing claims. *Nutrition.* 2017. https://www.fasebj.org/doi/abs/10.1096/fasebj.31.1_supplement.169.5. Published April 1, 2017. Accessed September 1, 2019.

27. O'Connor NR. Infant formula. *Am Fam Physician.* 2009; 79(7):565-70. https://www.ncbi.nlm.nih.gov/pubmed/19378873. Published April 1, 2009. Accessed September 1, 2019.

28. Przyrembel H, Agostoni C. Growing-up Milk: A Necessity or Marketing? *World Rev Nutr Diet.* 2013; 108:49-55. https://www.ncbi.nlm.nih.gov/pubmed/24029786. Published September 6, 2013. Accessed September 1, 2019.

29. Romo-Palafox MJ, Gershman H, Pomeranz J, Harris JL. Marketing claims of infant formula and toddler milk packages. UConn Rudd Center for Food Policy and Obesity; 2019. http://uconnruddcenter.org/files/Pdfs/Infant%20Formula%20and%20Toddler%20Milk%20Brief_9-23-19.pdf. Accessed October 1, 2019.

30. Cairncross CT, Stonehouse W, Conlon CA et al. Predictors of vitamin D status in New Zealand preschool children. *Matern Child Nutr.* 2017; 13(3). https://www.ncbi.nlm.nih.gov/pubmed/27460693. Published July 27, 2016. Accessed September 1, 2019.
31. Chouraqui JP, Turck D, Tavoularis G, Ferry C, Dupont C. The role of young child formula in ensuring a balanced diet in young children (1-3 years old). *Nutrients.* 2019; 11(9):2213. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6770074/. Published September 13, 2019. Accessed October 1, 2019.
32. Eussen SR, Pean J, Olivier L, Delaere F, Lluch A. Theoretical impact of replacing whole cow's milk by young-child formula on nutrient intake of UK young children. *Ann Nutr Metab.* 2015; 67(4):247-56. https://www.ncbi.nlm.nih.gov/pubmed/26492377. Published October 23, 2015. Accessed September 1, 2019.
33. Ghisolfi J, Fantino M, Turck D, de Courcy GP, Vidailhet M. Nutrient intakes of children aged 1-2 years as a function of milk consumption, cow's milk or growing up milk. *Public Health Nutr.* 2013; 16(3):524-34. https://www.ncbi.nlm.nih.gov/pubmed/23098567. Published July 4, 2012. Accessed September 1, 2019.
34. Walton J, Flynn A. Nutritional adequacy of diets containing growing up milks or unfortified cow's milk in Irish children (aged 12-24 months). *Food Nutr Res.* 2013; 57. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3849623/. Published December 2, 2013. Accessed September 1, 2019.
35. Hojsak I, Bronsky J, Campoy C et al. Young child formula: a position paper by the ESPGHAN Committee on Nutrition. *J Pediatr Gastroenterol Nutr.* 2018; 66(1):177-85.

https://journals.lww.com/jpgn/FullText/2018/01000/Young_Child_Formula__A_Position_Paper_by_the.34.aspx. Published January 2018. Accessed September 1, 2019.